

## *Worlds, Times and Selves Revisited (abstract)*

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**1. Cross-context identity: a problematic notion.** The notion of identity is notoriously problematic in modal settings. One way of approaching the problem, put forward by Hintikka [2, 3], is to understand individuals in modal settings as *world lines* creating links between objects in different possible worlds. As long as we only need to take into account a single world, we may think of individuals as objects wholly present in the world: as elements of its domain. Claims of cross-context identity, again, must be mediated by world lines. For conceptual clarity, I refer to the denizens of worlds as *local objects*. An individual is a link between local objects that makes it possible to speak of something remaining the same over a number of contexts. A local object may realize or manifest an individual, but it can never be an individual. All cross-context talk of individuals presupposes the availability of world lines. In our everyday lives we are quite capable of carrying out such talk: we reason about what might have happened in counterfactual circumstances to various entities we have encountered and speak of the existence over time of entities with which we are acquainted. An individual can, then, be seen as a partial function  $I$  defined on worlds, assigning to each world  $w$  on which it is defined an object  $I(w)$ . The *object*  $I(w)$  is a realization of  $I$  and it belongs to the domain of  $w$ , whereas the *individual*  $I$  itself does not reside in the domain of any world. This view on individuals does not require that individuals be associated with descriptive conditions; they are not essences. Neither are they individual concepts: first, they are not language-relative and second, they are not functions assigning individuals to worlds. I pointed out in [7] that if one adopts the understanding of individuals as world lines, both questions ‘Is  $a$  numerically identical to  $b$ ?’ and ‘Is  $a$  numerically distinct from  $b$ ?’ should be taken to be meaningless if ‘ $a$ ’ and ‘ $b$ ’ do not stand for objects in the domain of the same world. Questions of cross-world identity can only be posed when mediated by a world line: it can happen that  $a \in \text{dom}(w_1)$  and  $b \in \text{dom}(w_2)$  are realizations of the same individual in the sense that for some  $I$  we have  $a = I(w_1)$  and  $b = I(w_2)$ . Metaphysically, the logical distinction between individuals and local objects corresponds to the distinction that perdurantists make between things and their temporal parts. However, individuals in the sense intended here are not primarily conceived metaphysically. Rather, it is a precondition for any temporal and modal cognition pertaining to individuals that they be conceptualized as world lines. By being located in a specific scenario, any language user is directly confronted with local objects of that scenario. However, reasoning about an individual requires a certain conceptual command not only on the behavior of the individual in the specific scenario in which we find ourselves, but also on its temporal and modal behavior. Epistemologically, world lines have a primacy over local objects.

In [8] I argue that there is no more reason to regard the notion of ‘same time’ as unproblematic in modal settings than there is to so view the notion of ‘same individual’. Also times must be understood as world lines. We refer to local realizations of times as *instants*; a *time*  $T$  is a partial function assigning to each world  $w$  on which it is defined an instant  $T(w)$  in the temporal domain of  $w$ . If I utter ‘Jane could be in Alaska now’ in  $w$  at  $t$ , I am suggesting that in a certain counterfactual scenario  $v$  Jane is in Alaska – when? By the semantics of ‘now’, the time of Jane’s being in Alaska in  $v$  must be the *same* as the time of evaluation of the sentence. There must be a temporal world line  $T$  such that  $t = T(w)$  and in  $v$  Jane is in Alaska at  $s$ , where  $s = T(v)$ .

Prior pointed out that depending on the informal interpretation, one and the same ‘interior language’ can be seen as speaking of modalities or times or language users employing first-person pronouns [5, 6]; see also [1]. Adopting the understanding that cross-context sameness is to be explicated in terms of world lines, I ask in the present paper how the similar possibility of a plurality of interpretations manifests itself in connection with a language with quantifiers and two types of modal operators. Here one and the same language speaks of objects of several categories; the interpretations differ in how we construe the nature of the different categories.

**2. Construction of categories.** We begin with a set  $A$  of basic objects. These should be thought of as being local in all dimensions considered. Among conceivable such dimensions are time, worlds, and personhood. Relative to  $A$ , I define four further categories of entities, namely  $B$ ,  $C$ ,  $D$  and  $E$ . When suitably interpreted, among these four categories there will be *persons*, *instants*, *worlds* and *times*. The way in which the categories  $B$  to  $E$  will correspond to specific ontological categories is underdetermined by logic alone: several correlations are equally justified on purely logical grounds. This is why I use schematic considerations. Different correlations lead to different metaphysical overall views. I take it to be of some interest to note that they all result from interpreting the same categorial structure. When introducing the categories, I mention one possible interpretation – to be called ‘tense interpretation’ (**TI**) – in order to render the presentation easier to follow; afterwards I indicate further possible interpretations.

If  $X$  is a set and  $k$  is any cardinal number, a collection  $C = \{C_i : i < k\}$  of pairwise disjoint non-empty sets is a *subpartition* of  $X$ , if there is a subset  $Y$  of  $X$  such that  $Y = \bigcup_{i < k} C_i$ . The elements  $C_i$  of  $C$  are its *cells*. If  $S$  is a set,  $|S|$  is its cardinality. We introduce subpartitions  $B$  and  $C$  of  $A$ . On **TI**, the cells of  $B$  are *instants*, while those of  $C$  are *persons*.<sup>1</sup> Thus, local objects in a given set  $\mathbf{b} \in B$  are to be thought of as being simultaneous (i.e., existing at the same instant,  $\mathbf{b}$ ) and local objects belonging to a given set  $\mathbf{c} \in C$  as being realizations of the same (cross-world) person,  $\mathbf{c}$ . The two subpartitions cannot be arbitrary. They must satisfy: for all  $\mathbf{b} \in B$  and all  $\mathbf{c} \in C$ , we have  $|\mathbf{b} \cap \mathbf{c}| \leq 1$ . For a given instant  $\mathbf{b}$ , at most one of the local objects  $\mathbf{a} \in \mathbf{b}$  is a realization of a given individual  $\mathbf{c}$ . Next we move one abstraction step higher, and introduce subpartitions  $D$  and  $E$  of the set  $B$ . According to **TI**, the cells of  $D$  are *worlds* and those of  $E$  are *times*. Elements  $\mathbf{b} \in \mathbf{d} \in D$  make up the instants of a given world  $\mathbf{d}$ , and elements  $\mathbf{b} \in \mathbf{e} \in E$  are taken to be realizations of one and the same time  $\mathbf{e}$  understood as a cross-world entity. The subpartitions  $D$  and  $E$  are subject to the following condition: for all  $\mathbf{d} \in D$  and all  $\mathbf{e} \in E$ , we have  $|\mathbf{d} \cap \mathbf{e}| \leq 1$ . That is, for a given world at most one of the instants belonging to it is a realization of a given time. By contrast, the same  $\mathbf{c} \in C$  can intersect with any number of elements of  $B$ , several of which may belong to one and the same  $\mathbf{d} \in D$ . Finally, we assume there to be available a binary relation  $R$  on  $B$  and a binary relation  $S$  on  $D \times E$ . It is assumed that whenever  $R(\mathbf{b}, \mathbf{b}')$ , there is  $\mathbf{d} \in D$  such that  $\mathbf{b}, \mathbf{b}' \in \mathbf{d}$ . On **TI**, the relation  $R$  provides an order of temporal succession internally to each world  $\mathbf{d} \in D$ . Concerning the relation  $S$ , we suppose that if  $\langle (\mathbf{d}, \mathbf{e}), (\mathbf{d}', \mathbf{e}') \rangle \in S$ , then  $\mathbf{e} = \mathbf{e}'$  and  $\mathbf{e}$  is realized on both  $\mathbf{d}$  and  $\mathbf{d}'$ . We write  $S_e(\mathbf{d}, \mathbf{d}')$  for  $\langle (\mathbf{d}, \mathbf{e}), (\mathbf{d}', \mathbf{e}) \rangle \in S$ . On **TI**, the condition  $S_e(\mathbf{d}, \mathbf{d}')$  means that at time  $\mathbf{e}$  world  $\mathbf{d}'$  is a modal alternative to world  $\mathbf{d}$ . We refer to  $S$  as a *global* order (its relata are elements of  $D$ ), whereas  $R$  is referred to as a *local* order (its relata are elements of  $B$  belonging to one and the same element of  $D$ ).

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<sup>1</sup> More generally, on **TI** the elements of  $C$  are what we usually consider to be individuals (persons, material objects). However, simply referring to them as *individuals* would be misleading in this context: Prior’s discussion is partly motivated by the question of which things we should take seriously as individual entities.

**3. Interpretations.** We formulate a quantified modal language  $L$  involving quantifiers ( $\exists x$ ) and two modal operators, ‘weak’ ( $\Diamond_w$ ) and ‘strong’ ( $\Diamond_s$ ). It is evaluated relative to structures  $(A, B, C, D, E, R, S)$  of the type discerned in §2. Three ways of interpreting such structures are considered. We distinguish a *tense interpretation*, *modal interpretation (MI)*, and an *egocentric interpretation (EI)*. Depending on the interpretation, the language will result in an adaptation of Prior’s tense, modal or egocentric logic to our setting. Here is a schematic representation:

	<i>tense interpretation</i>	<i>modal interpretation</i>	<i>egocentric interpretation</i>
A	local objects	local objects	local objects (perceptions)
B	instants	world-states	states of mind
C	persons	persons	objects of perception
R	<i>earlier-later</i> relation	modal alternativeness	<i>earlier-later</i> relation
D	worlds	times	persons
E	times	worlds	times
S	modal alternativeness	<i>earlier-later</i> relation	ordering of persons

Categories B and C do not behave symmetrically. Elements of D and those of E are sets of elements of B, not of C. Further, elements of B appear as terms of the relation  $R$ . No relation on C is given. Neither do categories D and E behave symmetrically:  $S$  is an order on D, while no order is given whose terms would be elements of E; what can but need not happen is that for  $e, e' \in E$  there are  $b \in e$  and  $b' \in e'$  which are comparable in terms of the local order  $R$ . A necessary condition for so to happen is that  $b$  and  $b'$  belong to the same element of category D. The elements of the category A are the only ‘first-order objects’ involved. Elements of B and C are second-order objects, and those of D and E third-order objects.

*Tense interpretation.* Local objects are grouped into *instants* (B) which are grouped into *worlds* (D) ordered by the global relation of modal alternativeness ( $S$ ). Instants are considered to be world-internally ordered by the relation of temporal succession ( $R$ ). *Times* (elements of E) are sets of instants (elements of B). No order on times is directly provided by the structure. If  $e$  is a time and  $d$  is a world such that  $d \cap e \neq \emptyset$ , the unique instant  $b$  belonging to the intersection, denoted  $e(d)$ , is termed the *realization* of the time  $e$  in world  $d$ . The set C serves to group local objects into *persons*. If  $p$  is a person and  $t$  is an instant such that  $p \cap t \neq \emptyset$ , the unique local object  $a$  in this intersection, denoted  $p(t)$ , is termed the *realization* of the person  $p$  at instant  $t$ . If  $t = e(d)$ , then  $a$  may be derivatively termed the realization of  $p$  in world  $d$  at time  $e$ . The same person can be realized in many worlds, and at many instants in one and the same world.

*Modal interpretation.* Local objects are grouped into instantaneous *world-states* (B) which are grouped into *times* (D) ordered by the global relation of temporal succession ( $S$ ). World-states are time-internally ordered by the modal alternativeness relation ( $R$ ). *Worlds* (elements of E) are sets of world-states (elements of B). No order on worlds is provided by the structure. If  $e$  is a world and  $d$  is a time such that  $d \cap e = \{b\}$ , the world-state  $b = e(d)$  is the *realization* of the world  $e$  at time  $d$ . As with **TI**, also here the set C groups local objects into *persons*. If  $p$  is a person and  $w$  is a world-state such that  $p \cap w = \{a\}$ , the local object  $a = p(w)$  is the *realization* of  $p$  in  $w$ . If  $w = e(d)$ , then  $a$  may be derivatively termed the realization of  $p$  at time  $d$  in world  $e$ . The same person can be realized at many times, and in many world-states at one and the same time.

*Egocentric interpretation.* Prior considered his egocentric logic to be useful for understanding the philosophy of Leibniz. Pushing the Leibniz-inspired egocentric interpretation further, we may take local objects to be perceptions, grouped into *states of*

*mind* (B). These, again, are grouped into *persons* (D) – individual substances, monads – ordered by the global relation of relative perfection (*S*). States of mind are person-internally ordered by the local relation of temporal succession (*R*): this is what Leibniz calls appetition, i.e., an internal tendency of a substance to move from a state of perception to another [4, §15]. As in **TI**, *times* (elements of E) are sets of elements of B – sets of states of mind. Thus, times give sense to the idea of *simultaneity* of perceptions of different monads, this being a component of pre-established harmony in Leibniz. Things related by a time are states of mind, which again are sets of perceptions. No order on times is directly provided by the structure. If *e* is a time and *p* is a person with  $p \cap e = \{s\}$ , the state of mind  $s = e(p)$  is the *realization* of the time *e* in person *p*. The set C groups local objects into *intentional objects of perception*. Elements of C provide links enabling us to say that two individual substances have the same object of perception. If  $o \in C$  is an object of perception, *e* is a time, *p* is a person, and *s* is a state of mind such that  $s = e(p)$  and  $a = o(s)$ , the perception *a* of *p* – one of *p*'s perceptions in state *s* – has the object *o*, the perception *a* itself being a representation of the object *o* in the monad *p*. The same object can be represented in many individual substances, and at many times in one and the same substance.

**4. The three interpretations and language.** Consider a language *L* built from predicates and a set *Var* of variables using propositional connectives, quantifiers  $\exists x$  with  $x \in Var$  and modal operators  $\diamond_w$  and  $\diamond_s$ . Formulas are evaluated relative assignments  $g : Var \rightarrow C$  and pairs  $(d, e) \in D \times E$ , where *e* is required to be realized in *d*. A *model* is a structure  $(A, B, C, D, E, R, S, Int)$ , where *Int* is a function which assigns to every  $b \in B$  and every *n*-ary predicate *Q* a subset  $Int(Q, b)$  of the Cartesian product  $b \times \dots \times b$  (*n* times). The semantic behavior of atomic formulas is local. For example,  $M, d, e, g \models Q(x)$  iff the local object *a* belongs to the interpretation of the predicate *Q* relative to the object *b* of category B, where  $b = e(d)$  and *a* is the realization in *b* of the object  $g(x)$  of category C. The semantic clauses for quantifiers and the two modal operators are as follows:

- $M, d, e, g \models \exists x \psi$  iff there is  $p \in C$  s.t. *p* is realized at  $e(d)$  and  $M, d, e, g[x/p] \models \psi$
- $M, d, e, g \models \diamond_w \psi$  iff there is  $e' \in E$  realized in *d* s.t.  $\langle e(d), e'(d) \rangle \in R$  and  $M, d, e' \models \psi$
- $M, d, e, g \models \diamond_s \psi$  iff there is  $d' \in D$  with  $S_e(d, d')$  and  $M, d', e \models \psi$ .

Semantically,  $\diamond_w$  and  $\diamond_s$  are both quantifiers ranging over third-order objects (elements of E and D, respectively). Moreover, they both are relativized quantifiers. For  $\diamond_w$ , the relevant condition is phrased in terms of *realizations* of elements of E (second-order objects), while for  $\diamond_s$  the condition is in terms of elements of D (third-order objects). Let us take examples of what a fixed formula expresses depending on the interpretation applied.

**Example 1.** Suppose  $\psi$  has no free variables and  $M, d, e \models \diamond_w \diamond_s \psi$ . On **TI**, this means that it will be possible that  $\psi$ : there is a time *e'* such that instant  $e'(d)$  is later than instant  $e(d)$ , and at time *e'* there is an alternative world *d'* such that in *d'* at *e'*  $\psi$  is true. On **MI**, again,  $\diamond_w \diamond_s \psi$  being true in *d* at *e* means that it is currently possible that  $\psi$  will be true: there is a world *e'* such that world-state  $e'(d)$  is a modal alternative to world-state  $e(d)$ , and relative to world *e'* there is a time *d'* later than time *d* such that in *d'* at *e'*  $\psi$  is true. Finally, according to **EI** the sentence  $\diamond_w \diamond_s \psi$  is true when uttered by *d* at *e* iff there will be a person more perfect than the utterer such that  $\psi$  is true when uttered by that person then: there is a time *e'* such that state of mind  $e'(d)$  is later than state of mind  $e(d)$ , and at time *e'* there is a person *d'* more perfect than *d* such that  $\psi$  is true when uttered by *d'* at *e'*.

**Example 2.** Let  $\varphi$  be the formula  $\exists x \square_w(x = x \rightarrow \diamond_s x \neq x)$ , equivalent to  $\exists x \neg \diamond_w(x = x \ \& \ \square_s x = x)$ . Abstractly,  $M, \mathbf{d}, \mathbf{e} \models \varphi$  holds iff there is  $c \in C$  realized in  $\mathbf{e}(\mathbf{d})$  such that for any  $\mathbf{e}'$  realized in  $\mathbf{d}$  and satisfying  $R(\mathbf{e}(\mathbf{d}), \mathbf{e}'(\mathbf{d}))$  we have: if  $c$  is realized in  $\mathbf{e}'(\mathbf{d})$  as well, there is  $\mathbf{d}'$  with  $S_e(\mathbf{d}, \mathbf{d}')$  such that  $c$  fails to be realized in  $\mathbf{d}'$  at  $\mathbf{e}'$ . According to **TI**, this means that someone who presently exists will never become a necessary being: at no instant  $\mathbf{e}'(\mathbf{d})$  later than  $\mathbf{e}(\mathbf{d})$  will the person  $c$  in question be realized and satisfy  $\mathbf{d}, \mathbf{e}', x := c \models \square_s x = x$ . On **MI**, again, it means that a person,  $c$ , who actually exists cannot be an eternal being: in no world-state  $\mathbf{e}'(\mathbf{d})$  alternative to  $\mathbf{e}(\mathbf{d})$  is  $c$  realized while satisfying  $\mathbf{d}, \mathbf{e}', x := c \models \square_s x = x$ . And according to **EI**, this means that I have an object of perception,  $c$ , that will never, as long as I continue to perceive it, be perceived by everyone more perfect than me:  $\mathbf{d}$  has no state of mind  $\mathbf{e}'(\mathbf{d})$  subsequent to  $\mathbf{e}(\mathbf{d})$  such that the object  $c$  is perceived by  $\mathbf{d}$  at  $\mathbf{e}'(\mathbf{d})$  and satisfies  $\mathbf{d}, \mathbf{e}', x := c \models \square_s x = x$ .

**5. Conclusion.** Prior's discussion of worlds, times and selves was philosophically relevant for him in relation to several questions: (i) the conceptual priority of 'exterior' vs. 'interior' language; (ii) ontological commitments of our talk of modalities and time; and (iii) the question of which particular interior language is metaphysically fundamental. I do not address the issue (i); this would require explicitly comparing interior and exterior languages.<sup>2</sup> My comments remain within the interior perspective: I consider formulas evaluated on a structure  $(A, B, C, D, E, R, S)$ . Actually, in the general framework developed in [8] the contrast between tensed and tenseless discourse that Prior would have analyzed as the contrast between interior and exterior temporal language can be seen to emerge *within* our modal language – through the distinction between agent-relative (intentional) world lines and agent-independent (physical) world lines.

As to the issue (ii), in my five-category scheme the only first-order entities are objects of category A. Now, Prior took ontological commitment to be inversely proportional to modal involvement; cf. [5, p. 142]. He considered ontological commitments to be restricted to the values of *those* quantified variables which function as subjects of predicates. In connection with some domains of discourse, qualifying propositions by modalities can serve as a proxy for qualifying individuals by predicates. Our talk pertaining to such domains of discourse can, then, avoid ontological commitments by getting modally involved. Given the semantics of  $L$ , only local objects (elements of A) belonging to the same element of category B can function as subjects of predicates – if by 'subjects of an  $n$ -ary predicate  $P$  in  $\mathbf{b}$ ' we intend the members of those  $n$ -tuples that belong to the interpretation of  $P$  relative to  $\mathbf{b}$ . It should be noted, however, that in  $L$  the terms to which predicates are syntactically applied are variables, and the values of variables are *not* local objects but elements of category C. Relative to a fixed element  $\mathbf{b}$  of B such an element  $c$  of C then determines an element of A, if  $c$  is defined on  $\mathbf{b}$ . At any evaluation stage exactly one element  $\mathbf{b}$  of B is current. This element is determined as  $\mathbf{b} = \mathbf{e}(\mathbf{d})$ , i.e., the realization of the current E-parameter  $\mathbf{e}$  in the current D-parameter  $\mathbf{d}$ . The determined element of B may change only through the evaluation of a modal operator, which yields a shift in the E-parameter (weak modality) or in the D-parameter (strong modality). Objects of categories B and C are second-order objects and those of D and E third-order objects. In the present setting, ascent in logical type hierarchy can be construed as a movement towards increasingly abstract conceptualizations. Such conceptualizations are not subjective creations of language users. They are constitutive of our notions of cross-context identity. They are not primarily conceived metaphysically, but

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<sup>2</sup> In my setting the exterior language of comparison would not be *first-order* logic, but a generalization of *third-order* logic, with predicates applicable not only to first- but also to second- and third-order objects.

as preconditions of modal and temporal cognition. Consequently, reasoning in terms of elements of categories D and E can be considered as being ontologically less loaded than reasoning in terms of objects of categories B and C, while already categories B and C lead away from what can be seen as metaphysically primary, namely a fixed actual situation (element of category B), involving a number of realizations of certain elements of C, these realizations, as elements of category A, being first-order objects. Whereas Prior avoided ontological commitment to instants by viewing them as instant-propositions true of the non-linguistic context and by explicating the semantics of modal operators in terms of propositional quantification, in my setting we get a similar effect differently: by explicating the semantics in terms of higher-order quantification and defining the relevant higher-order entities from basic first-order entities taken to be ontologically basic. We can still say that speaking of entities of categories B to D is modally involved. These entities are not modally qualified propositions, but they are modal – cross-contextual – by nature.

Regarding the issue (iii), we see that three seemingly rather different metaphysical views result from differently interpreting one and the same structure of categories. The fact that the views have a common structural core is of systematic interest. Positively, it shows that the views are not as far removed from each other than it seems at first sight. Negatively, it suggests that as long as we have no independently motivated understanding of how the relevant notions (time, world, person) are interrelated – understanding that goes beyond what is explicated by our scheme – there is no justification for preferring one interpretation over the others. There are no *structural* reasons to favor one of the three interpretations. Suppose two philosophers share their pretheoretical notions of time, world and person. Suppose further that they agree on their analysis of cross-context identity: they share the understanding that speaking of entities of any of these types over a multitude of scenarios calls for the availability of world lines of a suitable kind. Suppose, finally, that their pretheoretical understanding of these notions is neutral with respect to the three interpretations. Distinct interpretations correspond to different ways of understanding the nature of the basic ontological categories. For example, **EI** as a reconstruction of Leibniz’s monadology would result from the perhaps more down-to-earth view represented by **TI** by keeping the underlying categorial structure the same but effecting a radical re-interpretation of the substantial role of the components of that structure: times remain times, but worlds of **TI** become persons in **EI** and persons of **TI** become intentional objects of perception in **EI**. Prior’s dilemma [6, p. 37] regarding the possibility of modalizing, not only our talk concerning times and worlds, but even our discourse pertaining to the ‘real world of individuals’ does not vanish but reappears also in the present setting.

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